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(54) SOFT DRINK COMPOSITIONS

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The present invention relates to improved beverage compositions, and more particularly relates to carbonated and non-carbonated beverages having superior thirst quenching properties, and which rapidly replace body fluids and salts lost during periods of activity.

In recent years, carbonated and non-carbonated soft drinks and beverages have become increasingly popular with people of all ages. Such beverages are relied upon to relieve thirst and to satisfy appetencies.

It is well known that there exist both psychological and physiological aspects of thirst, the satisfaction of both being important to man. Thus, for example, while water is the most satisfactory, readily available, thirst quenching fluid, it is bland and essentially tasteless. It often fails to provide psychological satisfaction. Furthermore, water is not rapidly absorbed into the bloodstream from the gastrointestinal tract. On the other hand, while the various, currently available flavored beverages provide psychological satisfaction, they do not satisfy the real physiological need to replace the water and salts lost during everyday activity. That is, while both water and currently available flavored beverages produce an immediate sense of wetting and cooling of the mouth and throat, they do not provide immediate or lasting satisfaction of physiological needs. Furthermore, the currently available beverages tend to be too sweet, or if sweetened with artificial sweetening agents, tend to leave an after-taste.

This invention provides an improved beverage composition adapted to rapidly quench thirst and replace lost body fluids and salts, said beverage composition comprising from about 20 to about 70 grams of dextrose per liter of aqueous solution, and from about

15 to about 50 milliequivalents (meq.) of sodium ions per liter of aqueous solution, in combination with compatible acids, flavoring agents, and sweetening agents, said composition having an osmolarity of from approximately 140 mOs./kg. to approximately 440 mOs./kg., and a pH of from 2.5 to 4.0. The compositions are adapted to be essentially isotonic, or slightly hypertonic if they are to be chilled with ice, when made up to the proper dilution.

It is to be understood that an isotonic solution is one which duplicates the osmotic pressure of the body, which is approximately 285 mOs./kg., but which naturally varies from individual to individual. The compositions of this invention can be prepared so that they initially are isotonic, or can be slightly hypertonic so that when they are chilled with ice, the dilution which is afforded by the melting ice provides an essentially isotonic solution.

In addition to the preferred compositions comprising sodium ions and dextrose in combination with compatible sweetening agents, acids, and flavoring agents, the compositions of this invention can contain up to approximately 20 meq./l. of chloride ions, up to approximately 28.0 meq./l. of phosphate ions, and up to approximately 10 meq./l. of potassium ions.

Accordingly, it is a primary object of this invention to provide improved beverage compositions which satisfy both psychological and physiological thirst requirements.

It is a further object of this invention to provide an essentially isotonic beverage comprising dextrose and electrolytes in contrast to the customary beverages that utilize sucrose and are hypertonic.

It is an object of this invention to provide essentially isotonic beverages which are palatable and can, therefore, be tolerated orally.

Still, a further object is to provide a pleasant, flavorful

refreshing soft drink containing such electrolytes which will aid the body in replenishing its needs quickly and effectively.

A further object of this invention is to provide various forms embodying the desired composition which can be made up into a still or carbonated beverage.

Other objects and advantages will become apparent to those skilled in the art from the following specification, drawings, and claims.

The present invention contemplates a beverage composition which, when made up to its proper dilution, provides an essentially isotonic solution which is rapidly absorbed into the system. The composition can be prepared in powder, liquid, concentrate or tablet form, and, when made up to its proper dilution, can be carbonated or non-carbonated.

The compositions of this invention comprise from about 20 to about 70 grams of dextrose per liter of aqueous solution, and from about 15 to about 50 milliequivalents (meq.) of sodium ions per liter of aqueous solution, in combination with compatible acids, flavoring agents and sweetening agents, said composition having an osmolarity of from approximately 140 to approximately 440 mOs./kg., and a pH of from 2.5 to 4.0.

The presence of compatible acids and compatible sweetening and flavoring agents is necessary to provide an essentially isotonic beverage composition which, when made up to proper dilution, is palatable and can be well tolerated orally.

In addition to sodium ions and dextrose, the compositions of the invention can additionally contain up to approximately 20 meq. of chloride ions per liter of aqueous solution, up to approximately 28.0 meq. of phosphate ions per liter of aqueous solution, and up to approximately 10 meq. of potassium ions per liter of aqueous solution. However, the presence of phosphate, chloride, and potassium ions is not essential. It is critical only that dextrose and sodium ions,

along with the acids, and sweetening and flavoring agents, be present in amounts such that the osmolarity of the beverage, when made up to its proper dilution, be between 140 and 440 mOs./kg.

The presently preferred concentrations of dextrose are from 30 to 60 grams per liter of aqueous solution, and the preferred concentrations of sodium ions are from 15 to 35 meq. per liter of aqueous solution.

The preferred sweetening agents which are utilized in the practice of this invention are the artificial sweetening agents such as sodium or calcium cyclamate, sodium or calcium saccharin, and the like, or combinations thereof. The artificial sweetening agents are generally present in amounts equal to from about 0.25 to about 2.5 g./l. In addition to the artificial sweetening agents, natural sweetening agents such as sucrose can also be used up to a level where they do not interfere or increase the isosmotic pressure of the composition in relation to body fluids. Normally, where sucrose is utilized, the amount of dextrose must be decreased to maintain the proper isosmotic pressure. It is preferred that the level of sucrose not exceed one third of the amount of dextrose normally included, and that the amount of dextrose by reduced accordingly to maintain the aforementioned isosmotic pressure. If this isosmotic level is passed, benefits derived from the use of such an isotonic solution are progressively decreased.

It will be obvious to those skilled in the art that still other sweetening agents can be utilized in the practice of this invention. Such other sweetening agents include dipeptides such as aspartylphenylalanine, methyl ester. The use of, for example, suitable amounts of aspartylphenylalanine, methyl ester, in place of a cyclamate and/or a saccharin, provides a satisfactory sweetening level for the compositions of this invention. Similarly, hexamic acid has been found to provide suitable sweetening levels when approximately 16 oz. per 100 gallons of beverage is utilized.

The following acids are illustrative of compatible acids which can be employed in the practice of this invention: citric, phosphoric, lactic, adipic, tartaric, hexamic, fumaric, malic, and like acids. Fruit acids, such as citric and the like, and phosphoric acid are the preferred acids.

Suitable flavoring agents include cola, lemon, lime, lemon-lime, cherry, punch, orange, grape, root beer, and the like. The flavoring agents are generally present in amounts of at least 10 ppm. or above on a weight basis, and can be varied to suit individual taste.

It is to be understood that sodium ions are advantageously provided by utilizing an acceptable (i.e., non-toxic, readily available, common) sodium salt, such as the chloride, carbonate, bicarbonate, citrate, phosphate, hydrogen phosphate, tartrate, benzoate, and the like, or a combination thereof. If potassium ions are present, they are also advantageously obtained by utilizing a suitable salt, such as the chloride, bicarbonate, citrate, phosphate, hydrogen phosphate, tartrate, sorbate, and the like, or a combination thereof.

Coloring agents can also be incorporated into the compositions of this invention. The type of coloring agents used is not critical, so long as it is non-toxic, and, if necessary, as in the case of many coloring agents, is approved by the Food, Drug, and Cosmetic Administration.

If a beverage of turbid or cloudy appearance is desired, clouding agents may also be incorporated into the compositions of this invention.

Preservatives, such as sodium benzoate and/or potassium sorbate can also be used when desired. Levels of 0.01 to 1.0% range are generally preferred. In carbonated beverages, for example, sodium benzoate is preferred. In the non-carbonated beverages, potassium sorbate is generally preferred.

Sequestering agents, such as ethylenediaminetetra acetic acid and its salts, such as the sodium calcium salts may also be used for maintaining flavor and color. Generally, preferred amounts are 5 to 500 parts per million, depending on the water supply used, the hardness of the water and the metal content. Usually 30 — 50 ppm. is adequate in good potable water.

The beverage compositions of this invention have a number of advantages over presently available soft drinks: (1) they contain electrolytes which help to compensate for those lost by the body during daily activities; (2) the electrolytes are in a dextrose medium which serves as a vehicle by which such salts are rapidly utilized by the body; (3) they are essentially isotonic solutions in their finished forms, and thus, water and electrolyte uptake by the body is improved; (4) such beverages have superior taste and palatability.

Thus the present invention provides flavorful carbonated or non-carbonated beverages in various flavors. Beverages in accord with this invention not only satisfy initial, psychological thirst by wetting and cooling the lips, mouth, throat, etc., but are utilized by the body more readily and quickly than are conventional beverages.

The compositions of this invention can be prepared either as the finished still or carbonated beverage, or in various concentrate forms, such as syrups, powder concentrates, dissolvable still or effervescent tablets, chewable tablets and the like. When such concentrates and tablets are diluted with or taken with a suitable amount of carbonated or non-carbonated water, or other aqueous fluids such as tea, coffee, and the like, they provide the same advantages and benefits as do the carbonated and non-carbonated liquid compositions of this invention. The compositions can also be mixed with various friut juices, punches, and the like.

The following examples further illustrate the present invention.

Example I

A beverage was prepared having the following composition:

	Percent (wgt.)
Dextrose (d-glucose)	4.8
NaH_2PO_4	0.294
KH_2PO_4	0.022
Citric Acid	0.250
Calcium Cyclamate	0.048
Water (deionized)	94.586

To the above composition can be added artificial coloring such as caramel, and flavoring agents such as cola, root beer, fruit punch, orange, lemon, lime, grape, etc. to provide an even more acceptable drink.

Example II

The following ingredients are combined to provide a beverage according to this invention.

	Percent (wgt.)
Dextrose	4.5
NaH_2PO_4	0.221
KH_2PO_4	0.030
Phosphoric Acid	0.059
Sodium Chloride	0.030
Sodium Saccharin	0.059
Water (deionized)	95.101

To the above composition can be added suitable amounts of flavoring, coloring, and clouding agents.

Example III

A beverage in accord with this invention is prepared by mixing the following ingredients:

	Percent (wgt.)
Dextrose	4.5
NaH_2PO_4	0.154
NaCl	0.030
KH_2PO_4	0.022
Sodium Citrate	0.015
Phosphoric Acid	0.059
Sodium Cyclamate	0.059
Sodium Saccharin	0.003
Cola Flavoring	0.15
Caramel Coloring	0.20
Water up to 100 percent	

Example IV

	Percent (wgt.)
Dextrose	6.000
Na_2HPO_4	0.088
NaCl	0.022
NaH_2PO_4	0.022
Citric Acid	0.294
Calcium Cyclamate	0.044
Sodium Saccharin	0.004
Lemon-Lime Flavoring	0.109
F.D. & C. Yellow No. 5	2.5 ppm.
Cloud	0.030
Water up to 100 percent	

In the above example, up to (one-third) 33-1/3% of dextrose can be replaced with sucrose. The levels of artificial sweeteners can then be lowered to taste.

Example V

The following ingredients are combined to provide a beverage in accord with this invention:

	Percent (wgt.)
Dextrose	3.000
NaH_2PO_4	0.118
Sodium Citrate	0.118
Potassium Citrate	0.030
Phosphoric Acid	0.015
Calcium Cyclamate	0.066
Calcium Saccharin	0.002
Root Beer Flavoring	0.15
Caramel Coloring	0.20
Water up to 100 percent	

Example VI

The following ingredients are combined to provide an orange-flavored beverage in accord with this invention:

	Percent (wgt.)
Dextrose	3.500
Na_3PO_4	0.132
NaCl	0.030
$NaHCO_3$	0.044
K_3PO_4	0.022
Citric Acid	0.353
Calcium Cyclamate	0.088
Sodium Saccharin	0.015
Orange Flavoring	14.0 Fl. Oz.
F.D. & C. Yellow No. 6	25.0 ppm.
Cloud	0.030
Water up to 100 percent	

Example VII

The following ingredients are combined to provide a lime-flavored beverage in accord with this invention:

	Percent (wgt.)
Dextrose	2.000
NaH_2PO_4	0.176
NA_2CO_3	0.015
KH_2PO_4	0.011
K_2HPO_4	0.011
Citric Acid	0.400
Sodium Citrate	0.030
Sodium Cyclamate	0.030
Sodium Saccharin	0.006
Lime Flavoring	0.118
F.D. & C. Yellow No.5	3.0 ppm.
Cloud	0.030
Water up to 100 percent	

The above composition was mixed with an equal volume of orange juice to provide a thirst-quenching orange drink.

Example VIII

The following ingredients are combined to provide a punch-flavored beverage of this invention:

	Percent (wgt.)
Dextrose	2.5
Na_2HPO_4	0.059
NaCl	0.030
K_2HPO_4	0.022
Sodium Citrate	0.030
Malic Acid	0.353
Calcium Cyclamate	0.059
Sodium Saccharin	0.003

Punch Flavoring	0.198
F. D. & C. Red No. 2	25.0 ppm.
F. D. & C. Yellow No.6	25.0 ppm.
Water up to 100 percent	

Example IX

The following ingredients are combined to provide a grape-flavored beverage in accord with this invention:

	Percent (wgt.)
Dextrose	4.000
NaH_2PO_4	0.221
Potassium Tartrate	0.022
Tartaric Acid	0.221
Sodium Cyclamate	0.088
Grape Flavoring	0.236
F. D. & C. Red No.2	25.0 ppm.
F. D. & C. Blue No. 1	2.5 ppm.
Water up to 100 percent	

Example X

The following ingredients are combined to provide a beverage in accord with this invention:

	Percent (wgt.)
Dextrose	5.000
Na_2HPO_4	0.147
NaCl	0.015
KCl	0.022
Citric Acid	0.353
Calcium Cyclamate	0.044
Sodium Saccharin	0.004
Lemon Flavoring	0.118
F. D. & C. Yellow No.5	25.0 ppm.
Cloud	0.030
Water up to 100 percent	

Examples XI-XX

The beverages of Examples I-X are carbonated by adding from 1.0 to 6.0 volumes of carbon dioxide thereto by methods well known in the art. Generally in such carbonated drinks a gas volume of 2.0 - 4.5 is preferred but in some cases we have found the volume of gas may be varied from 1.0 to 6.0 depending on the flavor used and the taste desired.

Dry formulations of the beverage of this invention can also be prepared. Such dry formulations are mixed with suitable amounts of a suitable fluid such as carbonated or non-carbonated water prior to the use thereof to provide an isotonic beverage. The dry formulations or mixes contain dextrose and electrolytes as taught above, and can be formulated in any flavor. The following example illustrates such a formulation:

Example XXI

A dry mix is prepared by combining the following:

	(Percent Wgt.)
Dextrose (anhydrous)	90.12
Citric Acid	4.56
Sodium Citrate (dihydrate)	0.95
Calcium Cyclamate	0.74
Cloud (Fritzsche No. 41715)	0.61
Alex Fries, lemon-lime Flavor Powder No.SD655	0.68
NaCl	1.54
NaH_2PO_4	0.27
KH_2PO_4	0.27
KCl	0.18
Sodium Saccharin	0.08
F.D. & C. Yellow No.5	48.0 ppm.

Two hundred grams of the above dry mix are reconstituted in one gallon of water to provide a flavorful beverage which quenches thirst

and is rapidly absorbed to replace lost fluids and salts.

Example XXII

A dry mix in accord with Example XXI was formulated by omitting the calcium cyclamate and increasing the amount of sodium saccharin to 0.2 percent by weight.

Example XXIII

A beverage mix having the following composition:

	Wgt. grams
Dextrose (anhydrous)	85.00
Citric Acid	4.00
NaCl	1.80
$NaH_2PO_4 \cdot H_2O$	1.50
$(Ca_3)\ 2(PO_4)2$	2.25
Calcium Cyclamate Sodium Saccharin (10:1)	0.35
Cloud Agent	.65
Norda-orange Flavor No. 465 Powder	.75
F.D. & C. Color No. 5 & 6 (70/30 ratio)	160.0 ppm.

was prepared as follows:

A coloring solution was prepared by first blending F.D.C. color No. 5 and No. 6 in 70/30 ratios and dissolving about 160 ppm. in 10cc. of water. About 85 grams of powdered dextrose were sifted into a laboratory mixer and the coloring solution was sprayed on the dextrose gradually. The resulting product had an orange-yellow color. Finely powdered tricalcium phosphate was then sifted on the mix to dry out the dextrose mix into a free flowing powder. Then the balance of the salts, flavorings, artificial sweetener, and clouding agents were added to the mix.

The resulting beverage mix can be packaged as a powder product and is ready to use when diluted with appropriate amounts of water.

Sodium Citrate	0.015
Potassium Chloride	0.010
Potassium Sorbate	0.020
Calcium Cyclamate	0.040
Cloud Agent	0.035
Artificial Color	0.030
Water	11.257

The above concentrate is then mixed with 5 parts by volume of water to form a beverage in accord with this invention.

The compositions of this invention can additionally be formulated as tablets which can be adapted to be swallowed with a suitable amount of fluids, or as effervescent tablets, that is, tablets, which when dissolved in water, or other suitable liquids, release carbon dioxide and effervescence.

The beverage compositions of this invention are useful not only for replacing body fluids, and salts lost during periods of activity, but are also useful for preventing dehydration in post-operative patients, patients suffering from episodes of flu, diarrhea, vomiting, and the like.

The compositions are also useful in increasing the rate of absorption of certain therapeutic agents such as antibiotics, analgesics, and the like, into the system when such compositions are administered substantially simultaneously with the particular therapeutic agent. The therapeutic agent can be administered along with the compositions of this invention in beverage, still tablet, or effervescent tablet form or can be formulated in the same tablet, filled capsule, elixir, suspension, etc.

The compositions of this invention can also be administered to various animals such as horses and the like to prevent dehydration and electrolytes lost during periods of activity. Rehydration or the prevention of dehydration is important, not only in humans but in many animals as well. Utilizing the isotonic solution of this invention

Example XXIV

A powder composition adapted to effervesce when added to water was prepared as follows:

To 50 grams of dextrose were mixed 1.7 grams of sodium bicarbonate and 3.0 grams of citric acid. To this mixture were added 0.45 grams of a calcium cyclamate and sodium saccharin blend (10-1) along with natural and artificial flavor and coloring agents. The blended mixture was packed in aluminum foil laminated with paper and plastic. Such packets, when mixed with 1 liter of water, makes a fizzy, tasty drink.

The above composition can also be compressed into tablets which dissolve and effervesce in water.

Example XXV

A punch-flavored beverage according to this invention was prepared according to Example VIII, but utilizing 2.25 oz. of sodium saccharin per 100 gallons of beverage as the sole sweetening agent.

Example XXVI

The beverage of Example XXV can also be made by substituting 1.0 gram of hexamic acid for the sodium saccharin, and lowering the citric acid content by 20 percent.

Example XXVII

A liquid concentrate, adapted to be diluted with 5 parts of water to 1 part of the liquid concentrate, was prepared by combining the following:

	Percent (wgt.)
Dextrose	4.900
Citric Acid	0.250
Sodium Chloride	0.083
Mono Basic Sodium Phosphate	0.015
Mono Basic Potassium Phosphate	0.015

for animals is well within the scope of this invention. In such cases the need for color, flavor and cloud are diminished or eliminated and the essential ingredients of the invention are utilized for rapid rehydration of the animals involved. The concentration of water, dextrose and the electrolytes to maintain the sodium ion concentration and the osmolarity level, which is suitable for the animal in question, becomes the prime objective and taste which is acceptable to the aminal is adjusted accordingly.

Having thus described the invention, what is desired to be claimed and secured by Letters Patent is:

1. An improved beverage composition adapted to rapidly quench thirst, and replace lost body fluids, said composition comprising from 20 to 70 g./l. of dextrose, and from 15 to 50 meq./l. of sodium ions in combination with a compatible acid, sweetening agent, and flavoring agent, said composition having an osmolarity of from about 140 to about 440 mOs./kg. and a pH of from 2.5 to 4.0

2. A composition in accord with Claim 1 additionally comprising up to 10 meq./l. of potassium ions.

3. A composition in accord with Claim 1 additiionally comprising up to 28 meq./l. of phosphate ions.

4. A composition in accord with Claim 1 additionally comprising up to 10 meq./l. of potassium ions and up to 28 meq./l. of phosphate ions.

5. A composition in accord with Claim 1 additionally comprising up to 20 meq./l. of chloride ions.

6. A composition in accord with Claim 1 additionally comprising up to 28 meq./l. of phosphate ions, up to 10 meq./l. of potassium ions, and up to 20 meq./l. of chloride ions.

7. A composition in accord with Claim 1 additionally comprising from 1.0 to 6.0 volumes of carbon dioxide.

8. A composition in accord with Claim 1 wherein said acid is selected from the group consisting of citric, phosphoric, lactic, adepic, tartaric, hexamic, fumaric or malic acid, or a combination thereof, said composition having a pH of from 2.5 to 4.0.

9. A composition in accord with Claim 1 wherein said sweetening agent is selected from the group consisting of sucrose, sodium cyclamate, calcium cyclamate, sodium saccharin, or calcium saccharin, or a combination thereof.

10. A composition in accord with Claim 1 wherein the flavoring agent is selected from the group consisting of cola, lemon, lemon-lime, cherry, punch, orange, grape and root beer flavoring agents.

11. A powder concentrate which, when dissolved in water, will form an essentially isotonic solution, said powder adapted to consist essentially of from 15 to 50 meq. of sodium ions per liter of aqueous solution, and from 20-70 grams of glucose per liter of aqueous solution, in combination with a compatible acid, sweetening agent, and flavoring agent, said concentrate having an osmolarity of from about 240 to about 400 mOs./kg. and a pH of 2.5 to 4.0 when made up to its proper dilution.

12. A liquid concentrate adapted for dilution with water to form an essentially isotonic solution, said concentrate consisting essentially of from 75 to 250 meq. of sodium ions and from 100 - 350 grams of glucose for each liter of water, in combination with a compatible acid, sweetening agent, and flavoring agent, said concentrate being adapted to be diluted with 5 parts by volume of fluid for each part by volume of concentrate so that the resulting beverage has an osmolarity of from 140 to 440 mOs./kg. and a ph of 2.5 to 4.0.

13. The product of claim 12 wherein the 1 part by volume of said concentrate is diluted with 5 parts by volume of water and the resulting beverage is treated with carbon dioxide until the absorbed volume of carbon dioxide is from 1.0 to 6.0.

14. The product of claim 1 wherein the resulting solution has a carbon dioxide gas volume of from 2.0 to 4.5.